Appendix A
Hydrologic Data for Maine

Contents

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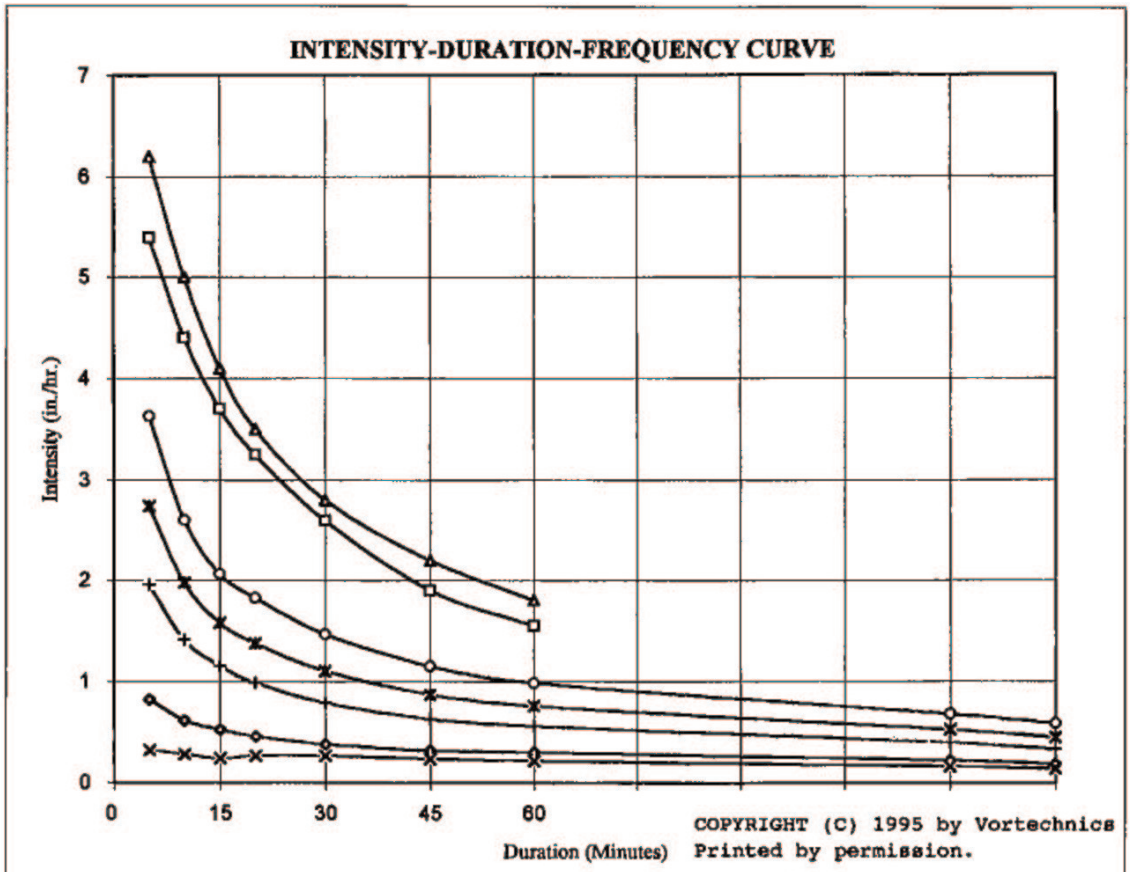
Appendix A-1: Intensity-Duration Curves (Vortechnics)



—△— 25 YEAR STORM

—□— 10 YEAR STORM

—○— 24 MONTH STORM

—✱— 12 MONTH STORM

—+— 6 MONTH STORM

—◇— 2 MONTH STORM - Represents a storm with a 1 in 2, (50%), chance of being equalled or exceeded in a given month.

—✕— 1.01 MONTH STORM - has a 99% chance of being equalled or exceeded in a given month.

NOTE: the 1-month storm would have a 100% chance of being equalled or exceeded in a given month; in other words, the 1-month rainfall intensity is zero inches per hour for all durations.

SOURCES:

Curves expressed in monthly recurrence intervals calculated by Tom Adams, P.E. from short term monthly maximum precipitation data from the Portland, Maine Jetport published by the U.S. Department of Commerce, National Climatic Data Center, Ashville, NC.

Sample Size = 144 months.

Statistical Method = Pearson Type III.

Curves expressed in yearly recurrence intervals compiled from the Stormwater Management Manual by the Greater Portland Council of Governments.

Appendix A-2: Portland & Cumberland County Precipitation Intensity/Duration (COG)

Portland & Cumberland County

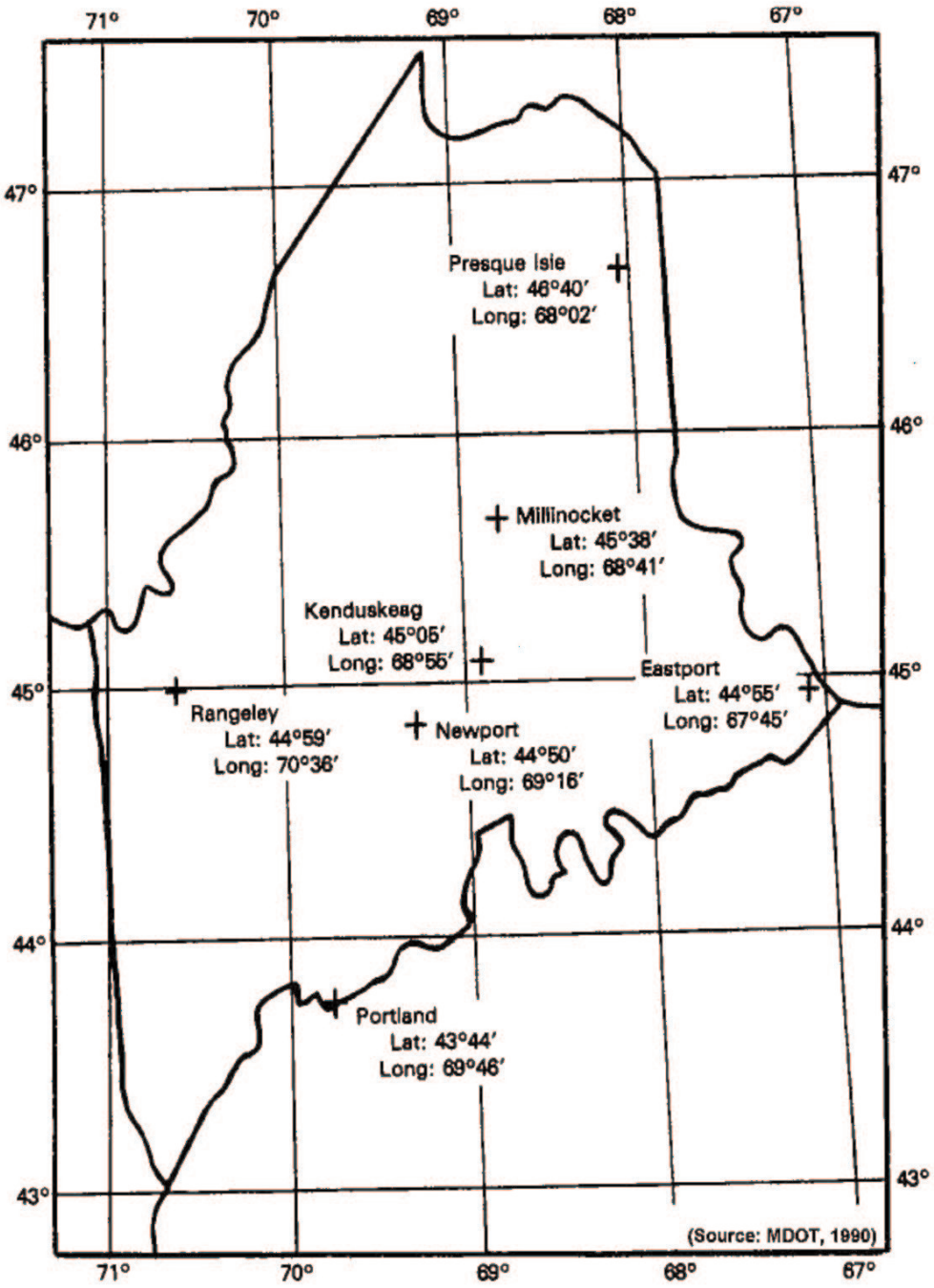
Precipitation Intensity/Duration

	2 years		5 years		10 years		25 years		50 years		100 years	
	Cumb. Co. (NOAA 35)	Portland (COG '81)	Cumb. Co. (NOAA 35)	Portland (COG '81)	Cumb. Co. (NOAA 35)	Portland (COG '81)	Cumb. Co. (NOAA 35)	Portland (COG '81)	Cumb. Co. (NOAA 35)	Port. (COG '81)	Cumb. Co. (NOAA35)	Portland (COG '81)
5 minute	0.34	0.312	0.40	0.368	0.45	0.410	0.52	0.471	0.58	0.520	0.63	0.568
10 minute	0.51	0.480	0.63	0.573	0.72	0.641	0.84	0.739	0.93	0.818	1.03	0.896
15 minute	0.63	0.579	0.79	0.699	0.90	0.786	1.05	0.912	1.18	1.01	1.30	1.11
30 minute	0.83	0.758	1.07	0.948	1.23	1.08	1.46	1.27	1.64	1.42	1.82	1.57
1 hour	1.04 (TP 40)	1.00	1.36 (TP 40)	1.24	1.58 (TP 40)	1.40	1.89 (TP 40)	1.65	2.13 (TP 40)	1.83	2.37 (TP 40)	2.02
2 hours	1.4	1.30	1.8	1.46	2.2	1.59	2.45	1.78	2.7	1.94	3.1	2.09
3 hours	1.6		2.1		2.45		2.7		3.1		3.5	
6 hours	2.1		2.65		3.1		3.4		4.0		4.4	
12 hours	2.5		3.4		3.9		4.8		5.0		5.7	
24 hours	3.0	3.18	4.0	3.87	4.7	4.37	5.5	5.08	5.8	5.65	6.7	6.21

TP 40 = "Rainfall Frequency Atlas", Government Printing Office, 1961
NOAA 35 = "Five to 60 Minute Precipitation Frequency for the Eastern and Central U.S.", National Weather Service 1977.
COG '81 = Hand calculations by Joan Feely (GPCOG intern), from "Rainfall Intensity-Frequency Analysis" - Form 612-47, Environmental Science Services Admin., Weather Bureau, adjusted for partial-duration series as in NOAA 35.

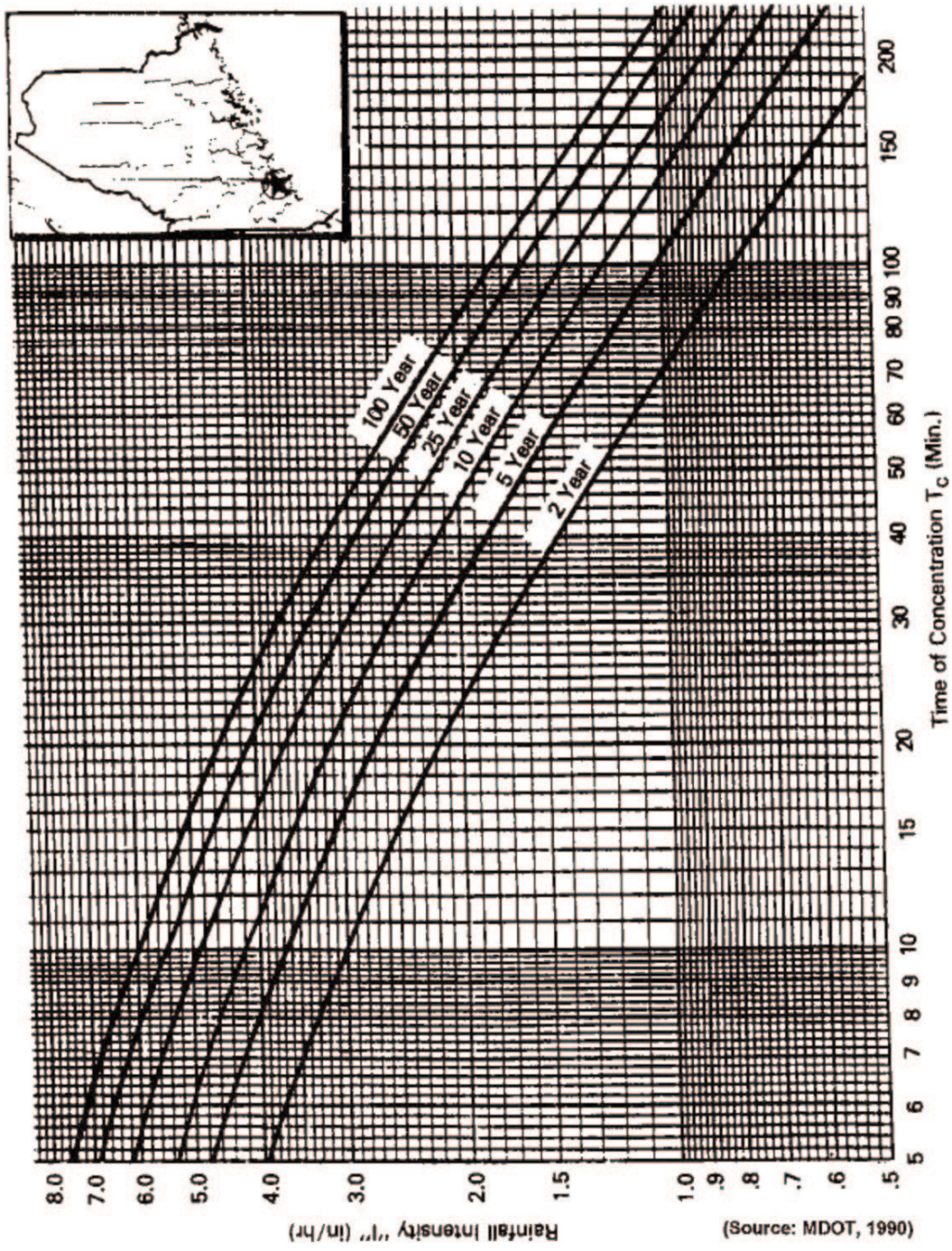
(Source: GPCOG, 1981)

Appendix A-3: IDF Reference Sites in Maine (MDOT)



IDF REFERENCE SITES IN MAINE
(Rational Method)

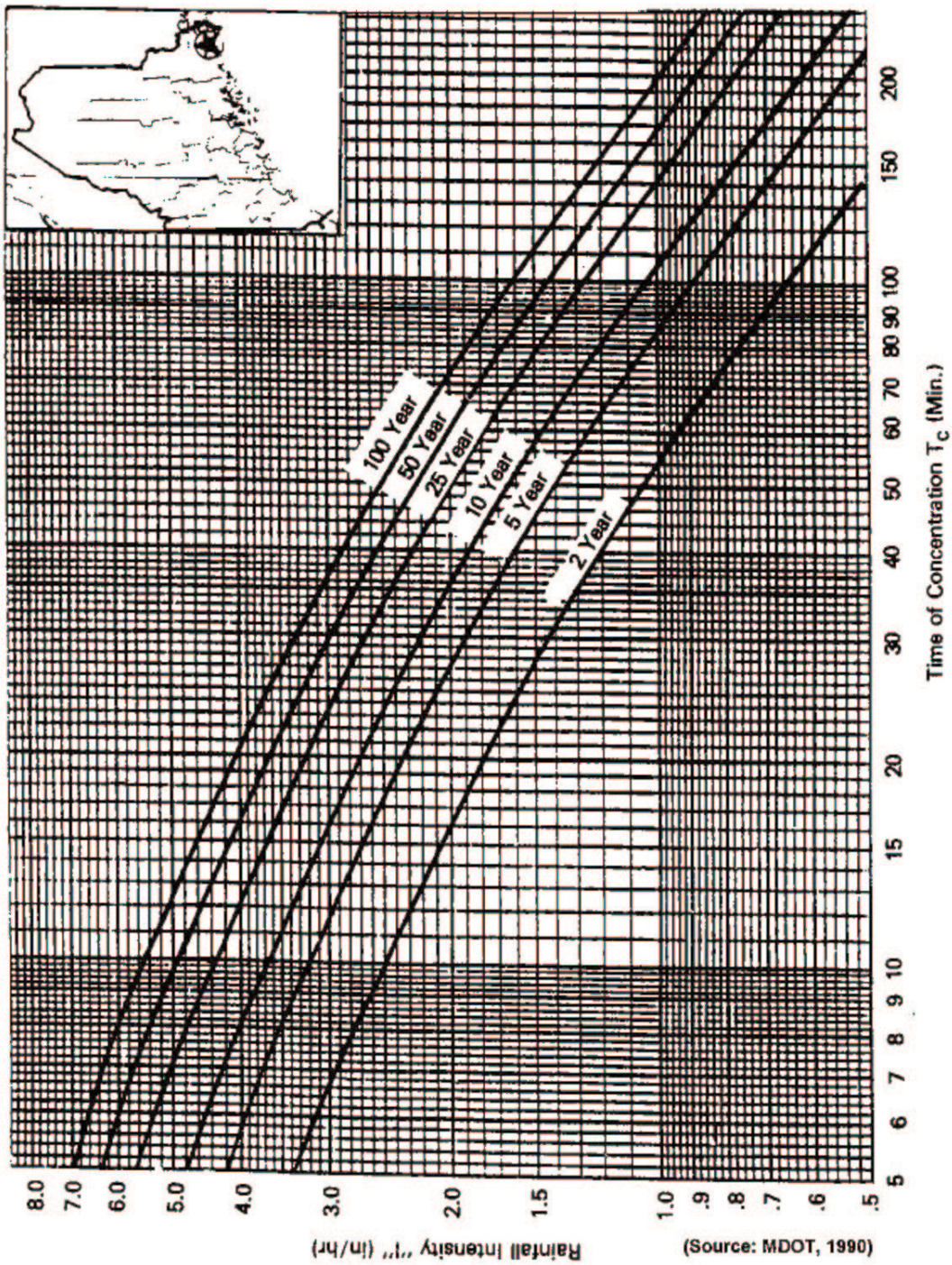
Appendix A-4: IDF Curve for City of Portland



IDF CURVE FOR CITY OF PORTLAND
(Rational Method)

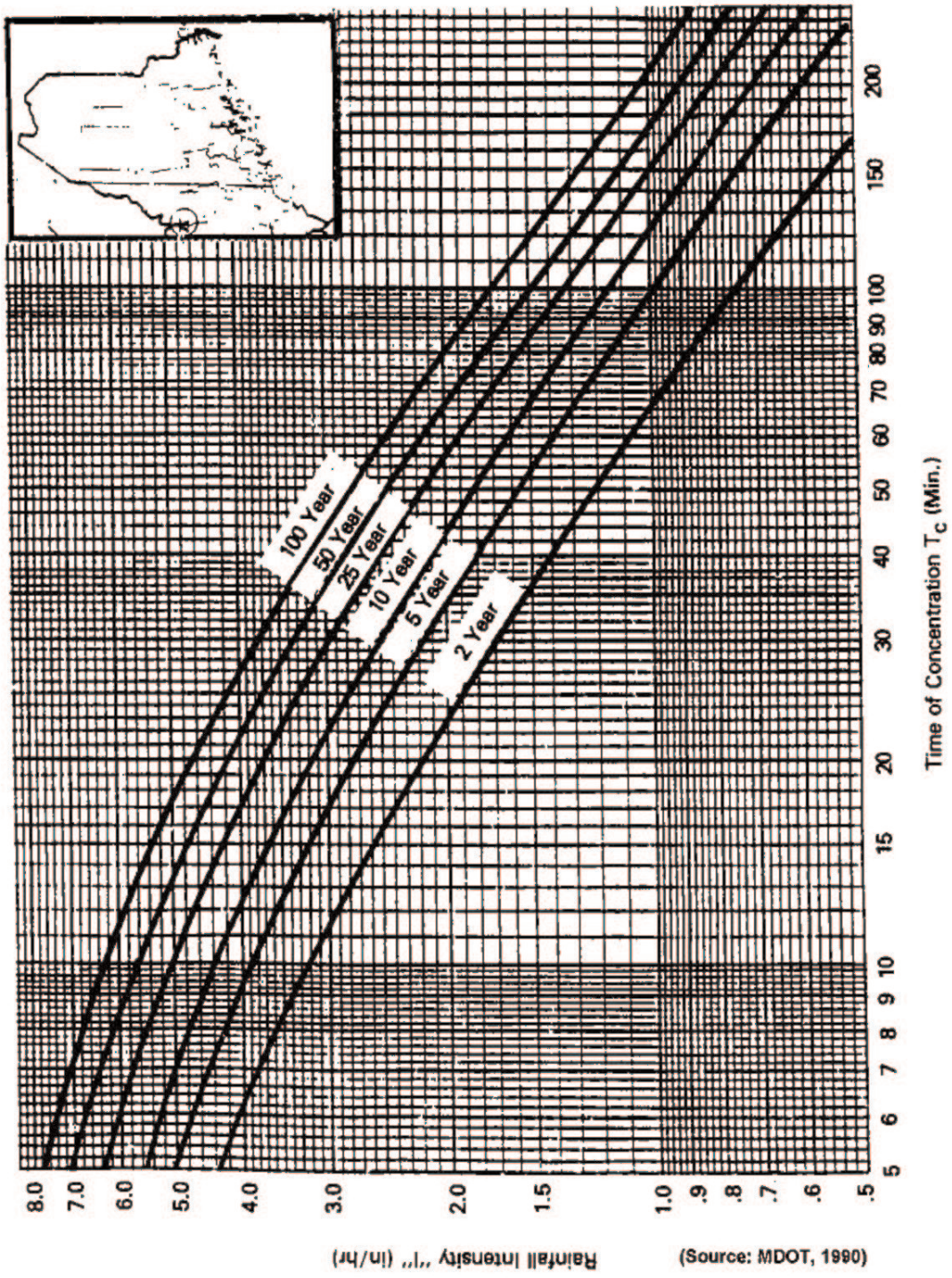
3

Appendix A-5: IDF Curve for City of Eastport



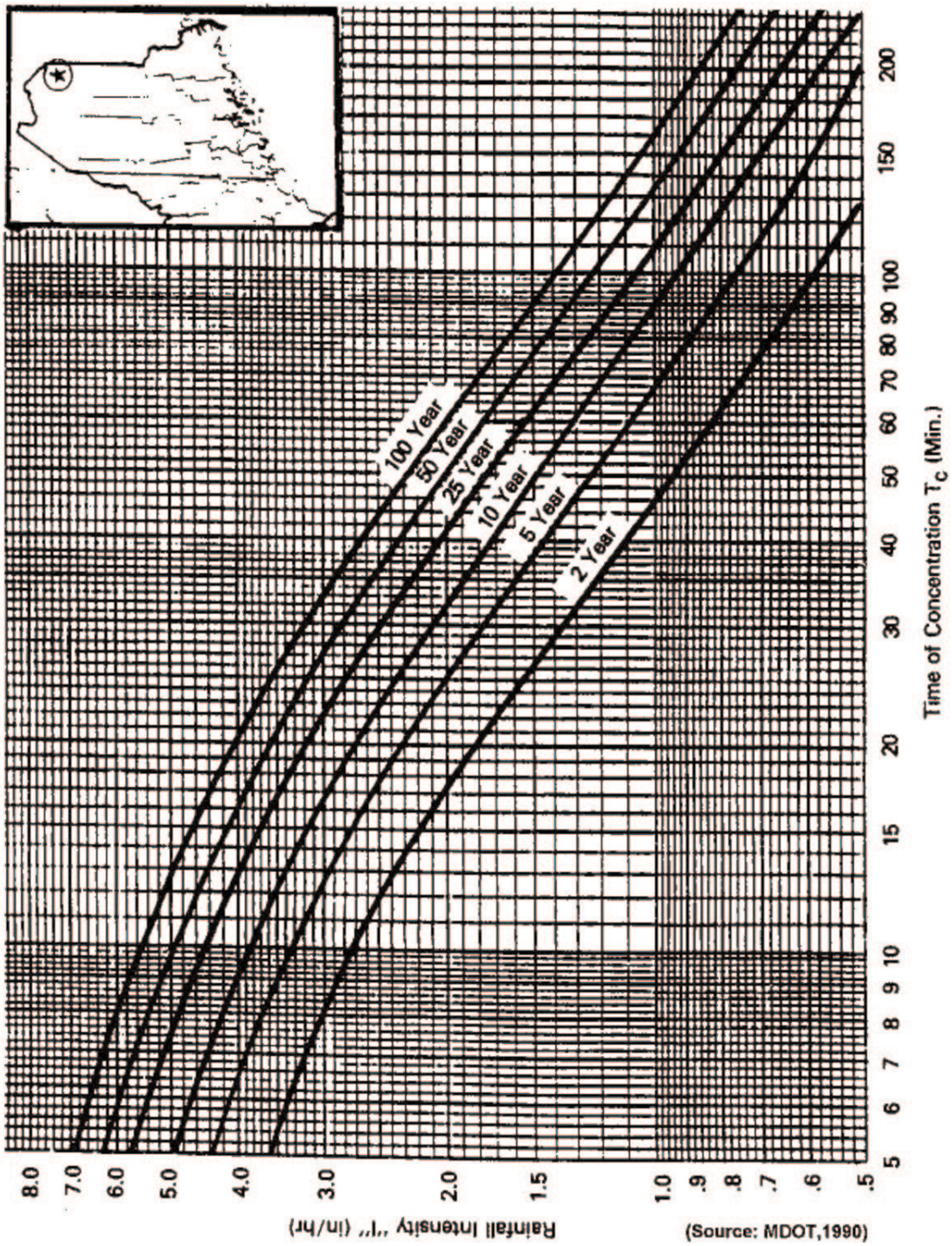
IDF CURVE FOR CITY OF EASTPORT
(Rational Method)

Appendix A-6: IDF Curve for Town of Rangeley



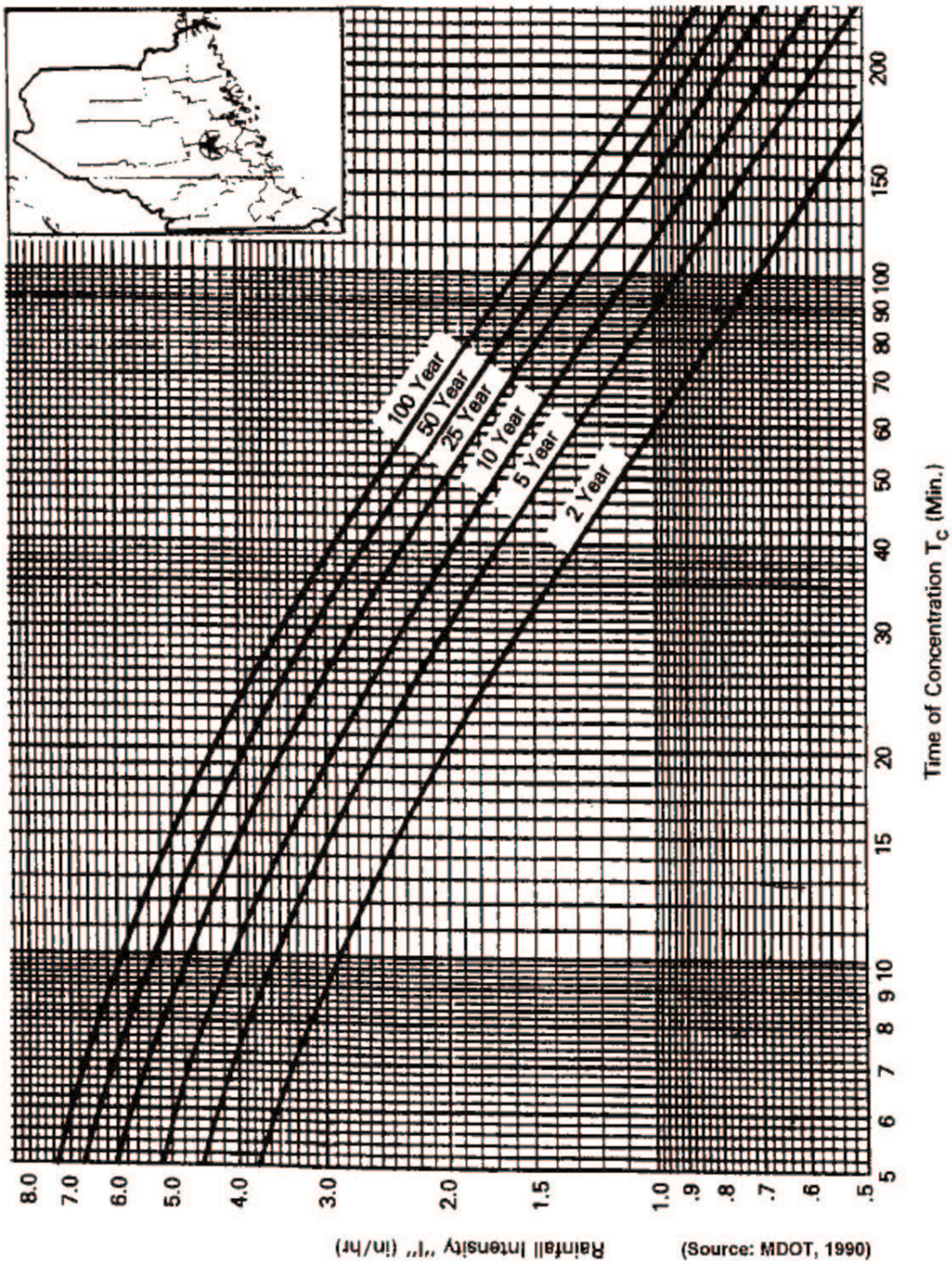
IDF CURVE FOR TOWN OF RANGELEY
(Rational Method)

Appendix A-7: IDF Curve for City of Presque Isle



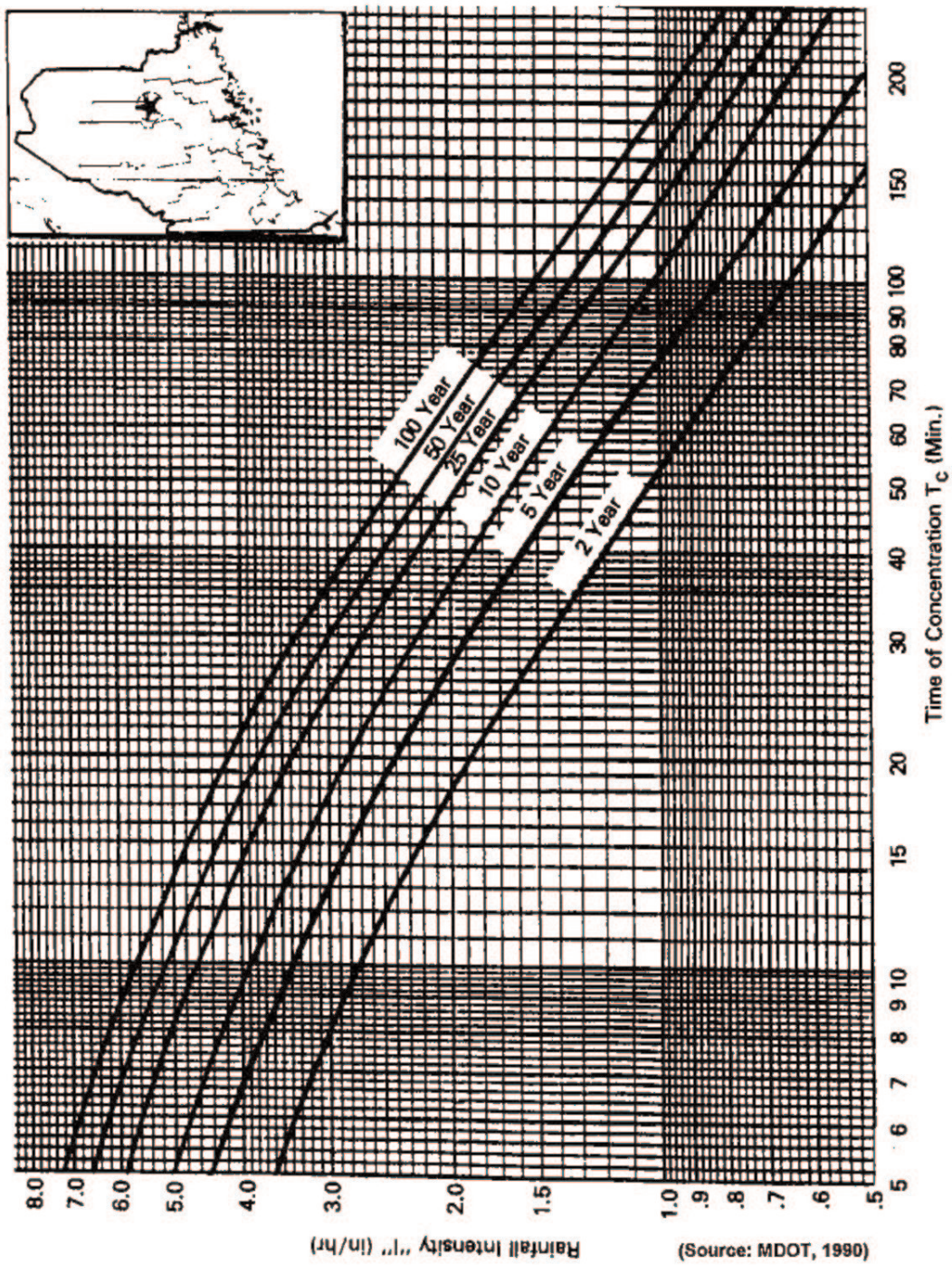
IDF CURVE FOR CITY OF PRESQUE ISLE
(Rational Method)

Appendix A-8: IDF Curve for Town of Newport



IDF CURVE FOR TOWN OF NEWPORT
(Rational Method)

Appendix A-9: IDF Curve for Town of Millinocket



IDF CURVE FOR TOWN OF MILLINOCKET
(Rational Method)

Appendix A-10: Runoff Coefficients for the Rational Formula

Typical Composite Runoff Coefficients by Land Use.	
Description of Area	**C-value**
Business:	
Downtown areas	0.70-0.95
Neighborhood areas	0.50-0.70
Residential:	
Single-family areas	0.30-0.50
Multi units, detached	0.40-0.60
Multi units, attached	0.60-0.75
Suburban	0.25-0.40
Apartment	0.50-0.70
Industrial:	
Light areas	0.50-0.80
Heavy areas	0.60-0.90
Parks, cemeteries	0.10-0.25
Playgrounds	0.20-0.35
Railroad yard areas	0.20-0.35
Unimproved areas	0.10-0.30

Normal Range of Runoff Coefficients.	
Character of Surface	**C-value**
Lawns:	
Sandy soil, flat (2%)	0.05-0.10
Sandy soil, ave. (2-7%)	0.10-0.15
Sandy soil, steep (7%)	0.15-0.20
Heavy soil , flat (2%)	0.13-0.17
Heavy soil, ave. (2-7%)	0.18-0.22
Heavy soil, steep (7%)	0.25-0.35
Agricultural land:	
Bare packed soil	
Smooth	0.30-0.60
Rough	0.20-0.50
Cultivated rows	
Heavy soils, no crop	0.30-0.60
Heavy soils with crop	0.20-0.50
Sandy soil no crop	0.20-0.40
Sandy soil with crop	0.10-0.25
Pasture	
Heavy soil	0.15-0.45
Sandy soil	0.05-0.25
Woodlands	0.05-0.25
Pavement	
Asphalt and Concrete	0.70-0.95
Brick	0.70-0.85
Roofs	0.75-0.95

NOTE: The designer must use judgment to select the appropriate "C" value within the range for the appropriate land use. Generally, larger areas with permeable soils, flat slopes, and dense vegetation should have lowest "C" values. Smaller areas with slowly permeable soils, steep slopes, and sparse vegetation should be assigned highest "C" values. The range of "C" values presented are typical for return periods of 2-10 years. Higher values are appropriate for larger design storms. (ASCE 1992 and others)

Appendix A-11: Runoff Coefficients for the Rational Formula by Hydrologic Soil Group and Slope

Runoff Coefficients for the Rational Formula by Hydrologic Soil Group and Slope

Range *

Land use	A			B			C			D		
	0–2%	2–6%	6%+	0–2%	2–6%	6%+	0–2%	2–6%	6%+	0–2%	2–6%	6%+
Cultivated land	0.08	0.13	0.16	0.11	0.15	0.21	0.14	0.19	0.26	0.18	0.23	0.31
	0.14	0.18	0.22	0.16	0.21	0.28	0.20	0.25	0.34	0.24	0.29	0.41
Pasture	0.12	0.20	0.30	0.18	0.28	0.37	0.24	0.34	0.44	0.30	0.40	0.50
	0.15	0.25	0.37	0.23	0.34	0.45	0.30	0.42	0.52	0.37	0.50	0.62
Meadow	0.10	0.16	0.25	0.14	0.22	0.30	0.20	0.28	0.36	0.24	0.30	0.40
	0.14	0.22	0.30	0.20	0.28	0.37	0.26	0.35	0.44	0.30	0.40	0.50
Forest	0.05	0.08	0.11	0.08	0.11	0.14	0.10	0.13	0.16	0.12	0.16	0.20
	0.08	0.11	0.14	0.10	0.14	0.18	0.12	0.16	0.20	0.15	0.20	0.25
Residential												
Lot size $\frac{1}{8}$ acre	0.25	0.28	0.31	0.27	0.30	0.35	0.30	0.33	0.38	0.33	0.36	0.42
(0.05 ha)	0.33	0.37	0.40	0.35	0.39	0.44	0.38	0.42	0.49	0.41	0.45	0.54
Lot size $\frac{1}{4}$ acre	0.22	0.26	0.29	0.24	0.29	0.33	0.27	0.31	0.36	0.30	0.34	0.40
(0.10 ha)	0.30	0.34	0.37	0.33	0.37	0.42	0.36	0.40	0.47	0.38	0.42	0.52
Lot size $\frac{1}{3}$ acre	0.19	0.23	0.26	0.22	0.26	0.30	0.25	0.29	0.34	0.28	0.32	0.39
(0.13 ha)	0.28	0.32	0.35	0.30	0.35	0.39	0.33	0.38	0.45	0.36	0.40	0.50
Lot size $\frac{1}{2}$ acre	0.16	0.20	0.24	0.19	0.23	0.28	0.22	0.27	0.32	0.26	0.30	0.37
(0.2 ha)	0.25	0.29	0.32	0.28	0.32	0.36	0.31	0.35	0.42	0.34	0.38	0.48
Lot size 1 acre	0.14	0.19	0.22	0.17	0.21	0.26	0.20	0.25	0.31	0.24	0.29	0.35
(0.4 ha)	0.22	0.26	0.29	0.24	0.28	0.34	0.28	0.32	0.40	0.31	0.35	0.46
Industrial	0.67	0.68	0.68	0.68	0.68	0.69	0.68	0.69	0.69	0.69	0.69	0.70
	0.85	0.85	0.86	0.85	0.86	0.86	0.86	0.86	0.87	0.86	0.86	0.88
Commercial	0.71	0.71	0.72	0.71	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72
	0.88	0.88	0.89	0.89	0.89	0.89	0.89	0.89	0.90	0.89	0.89	0.90
Streets	0.70	0.71	0.72	0.71	0.72	0.74	0.72	0.73	0.76	0.73	0.75	0.78
	0.76	0.77	0.79	0.80	0.82	0.84	0.84	0.85	0.89	0.89	0.91	0.95
Open space	0.05	0.10	0.14	0.08	0.13	0.19	0.12	0.17	0.24	0.16	0.21	0.28
	0.11	0.16	0.20	0.14	0.19	0.26	0.18	0.23	0.32	0.22	0.27	0.39
Parking	0.85	0.86	0.87	0.85	0.86	0.87	0.85	0.86	0.87	0.85	0.86	0.87
	0.95	0.96	0.97	0.95	0.96	0.97	0.95	0.96	0.97	0.95	0.96	0.97

*First row of each entry gives runoff coefficients for storm recurrence intervals less than 25 years; second row gives runoff coefficients for storm recurrence intervals of 25 years or more.

(Source: Rawls et.al., 1981)

(Source: Rawls et al., 1981, and Browne, 1990)

Appendix A-12: Runoff Curve Numbers for use in TR-55 and TR-20

Land Use/Cover type and hydrologic condition	Hydrologic Soil Group A	B	C	D
Cultivated Land				
without conservation	72	81	88	91
with conservation	62	71	78	81
Pasture land				
poor condition: heavily grazed, no mulch	68	79	86	89
fair condition: 50 to 75% ground cover	49	69	79	84
good condition: lightly grazed, > 75% ground cover	39	61	74	80
Meadow (protected from grazing)	30	58	71	78
Wood or forest land				
Thin stand - poor cover, no mulch, burned over	45	66	77	83
Good stand - good cover, litter and brush cover soil	25	55	70	77
Wood yard (log storage)	72	82	87	89
Open space, lawns, parks, golf courses, cemeteries, etc.				
Good condition: grass cover on 75% or more of the area	39	61	74	80
Fair condition: grass cover on 50 to 75 % of the area	49	69	79	84
Commercial and business areas (85% impervious)	89	92	94	95
Industrial districts (72% impervious)	81	88	91	93
Residential: Development completed, vegetation established, house and driveway drains toward road				
Average lot size / Average % impervious				
1/8 acre or less (town houses) 65	77	85	90	92
1/4 acre 38	61	75	83	87
1/3 acre 30	57	72	81	86
1/2 acre 25	54	70	80	85
1 acre 20	51	68	79	84
2 acre 15	46	65	77	82
Paved parking lots, roofs, driveways, etc.(excluding R-O-W)	98	98	98	98
Streets and roads				
Paved with curb and storm sewers (excluding R-O-W)	98	98	98	98
Paved with ditches (including R-O-W)	83	89	92	93
Gravel (including R-O-W)	76	85	89	91
Dirt (including R-O-W)	72	82	87	89
Newly graded area (denuded)	77	86	91	94

Note: Average runoff condition and $I_a = 0.2S$

Source: SCS, 1986 and DEP staff.

Appendix A-13: Curve Number Adjustments Based on Differing AMCs

Curve Numbers and Constants for the case Ia = 0.2S									
CN for AMC II	CN for AMC I	CN for AMC III	S* value (in.)	I_a	CN for AMC II	CN for AMC I	CN for AMC III	S* value (in.)	I_a
100	100	100	0	0	60	40	78	6.67	1.33
99	97	100	0.101	0.02	59	39	77	6.95	1.39
98	94	99	0.204	0.04	58	38	76	7.24	1.45
97	91	99	0.309	0.06	57	37	75	7.54	1.51
96	89	99	0.417	0.08	56	36	75	7.86	1.57
95	87	98	0.526	0.11	55	35	74	8.18	1.64
94	85	98	0.638	0.13	54	34	73	8.52	1.70
93	83	98	0.753	.015	53	33	72	8.87	1.77
92	81	97	0.870	.017	52	32	71	9.23	1.85
91	80	97	0.989	0.20	51	31	70	9.61	1.92
90	78	96	1.11	0.22	50	31	70	10.0	2.00
89	76	96	1.24	0.25	49	30	69	10.4	2.08
88	75	95	1.36	0.27	48	29	68	10.8	2.16
87	73	95	1.49	0.30	47	28	67	11.3	2.26
86	72	94	1.63	0.33	46	27	66	11.7	2.34
85	70	94	1.76	0.35	45	26	65	12.2	2.44
84	68	93	1.90	0.38	44	25	64	12.7	2.54
83	67	93	2.05	0.41	43	25	63	13.2	2.64
82	66	92	2.20	0.44	42	24	62	13.8	2.76
81	64	92	2.34	0.47	41	23	61	14.4	2.88
80	63	91	2.50	0.50	40	22	60	15.0	3.00
79	62	91	2.66	0.53	39	21	59	15.6	3.12
78	60	90	2.82	0.56	38	21	58	16.3	3.26
77	59	89	2.99	0.60	37	20	57	17.0	3.40
76	58	89	3.16	0.63	36	19	56	17.8	3.56
75	57	88	3.33	0.67	35	18	55	18.6	3.72
74	55	88	3.51	0.70	34	18	54	19.4	3.88
73	54	87	3.70	0.74	33	17	53	20.3	4.06
72	53	86	3.89	0.78	32	16	52	21.2	4.24
71	52	86	4.08	0.82	31	16	51	22.2	4.44
70	51	85	4.28	0.86	30	15	50	23.3	4.66
69	50	84	4.49	0.90					
68	48	84	4.70	0.94	25	12	43	30.0	6.00
67	47	83	4.92	0.98	20	9	37	40.0	8.00
66	46	82	5.15	1.03	15	6	30	56.7	11.34
65	45	82	5.38	1.08	10	4	22	90.0	18.00
64	44	81	5.62	1.12	5	2	13	190.0	38.00
63	43	80	5.87	1.17	0	0	0	∞	∞
62	42	79	6.13	1.23					
61	41	78	6.39	1.28					

Source: Browne, 1990; SCS 1972

*For CN listed for AMC Condition II; S=((1000/CN)-10), I_a=0.2S